The Mining Journal.

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ORIGINAL CORRESPONDENCE.

AMERICAN LEAD MINES.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—In your Number of the 5th of November last, I observed, under the signature of "A Lead Miner," a valuable commentary on the Memoir of Mr. Hodge, respecting the lead mines of the United States.

Your correspondent asks for further information on a subject of much interest to the English lead miner, and it has been my good fortune to receive it from two highly intelligent persons, natives of this neighbourhood, who have recently returned from the Wisconsin mines. As they have been several years in that district, and one of them in Missouri also, and as they are proprietors of land as well as lead mines in Wisconsin, and have devoted the whole of their lives to the joint occupations of mining and smelting, their testimony becomes of great value in various particulars, which only practical men can furnish.

Without trespassing on your valuable space, by going into details which may be too lengthy for a communication of this nature, I will shortly lay before you the general impression derived from them, especially on those points in which my informants differ in any respect from the statements of Mr. Hodge. With regard to the nature of the country, the extent of the lead district, and the character of the veins, they agree with him in his general description of them, as in other important particulars. But they differ in some measure in their statement of the expense of producing the ore, smelting, and the cost of conveying the lead to market.

In the first place the deposits are represented as being in many cases extremely rich, especially in the neighbourhood of Platteville, a place about eighteen miles from Mineral Point, in the direction of Galena. One of these veins was worked by three men for about two years, in which time they excavated the vein for the length of seventy-five fathoms, and to the average depth of about twenty-five feet, at which depth the works were left rich, but were abandoned on finding water along the bottom. These workings were chiefly in clay, the vein being to the width of from ten to twenty feet, and yielding on an average more than twelve tons per fathom. The ease with which the ore is extracted in such situations may be judged of from the fact, that the whole ore raised in the two years (about 4000 tons) might, if needful, have been brought to the surface by three men in about seven months of full work.

My informants stated that they had known other deposits equally rich. There are also many smaller veins, several of which cannot be worked to profit at the price for which ore has been selling for some time past. With respect to the wages of the miners, my informants state that they are much reduced in the last few years. The most experienced do not now receive more than 25*s.* to 30*s.* per week, but as the workings are generally such as not to require men of that class, a large portion of the work is done by labourers, who receive about 15*s.* per week. A few years ago, the best miners received as much as 3*l.* per week, and the labourers were paid highly in proportion. The cost of smelting is also materially reduced since the introduction of the ore hearth, which is now in general use. The reverberatory furnace being employed only where water-power cannot be obtained; wood being an unsuitable fuel for it. The cost of smelting by the hearth is stated to be about 5*s.* per 1000 lbs. of ore, or about 11*s.* 3*d.* per ton. The average produce from the hearth is about 70 per cent. of lead; the richest ores yielding 75 per cent. With regard to the cost of conveying the lead to market after it leaves the smelter's hands, my informants differ materially from the estimate formed by Mr. Hodge.

The continued fall in the rate of freight on the Mississippi, has so far reduced the cost of transit, that lead can now be conveyed from the smelting works in the neighbourhood of Mineral Point to New York for about 2*l.* 10*s.* per ton, including all expenses. The mode of conveyance from Galena to New Orleans is by steam vessels, which ply regularly on the Mississippi, and which perform the passage in nine days. The return passage requires a day or two longer. The parties who gave me this information, having recently paid for the conveyance of lead from the mines to New York, was enabled to give me the various items which make up the whole cost to New Orleans, from whence the lead goes to New York as ballast. It is also taken as ballast by ships sailing from New York to European ports, or to China; so that the whole expenses of conveyance from the mines in the "far west" to the various parts of the "old world," are extremely moderate.

When this circumstance is taken into account, together with the richness of the mineral deposits, the facility with which the ore is brought to the surface, the moderate rate of labour, and the small cost of smelting, it appears somewhat extraordinary that the produce of the mines should not have increased more rapidly. This apparent anomaly can only be explained by persons, like my informants, who are practically acquainted with the difficulties of mining in such a district; and their information, derived from long experience, will probably have its due weight with some of my over-sanguine countrymen, who may be tempted to cross the Atlantic, by the visionary notions which have prevailed respecting this new "El Dorado," and who will find themselves grievously disappointed on arriving there.

The real impediments to profitable working, and to consequent increase in the produce of the mines, consist chiefly in the difficulty of *discovery of veins*, and the shallow depth to which they can be worked without resorting to means of drainage, for which it appears there is not sufficient inducement. In mines circumstanced like these, the exhaustion of the metalliferous deposits is so rapid, that unless fresh discovery can be kept up, at a corresponding rate, the produce of such a district must relax, and finally diminish. That this is actually the case now there can be no doubt, for my informants state, that through a large portion of the Wisconsin district there is not, at the present time, one-fifth of the ores discovered which was in sight a few years ago.

To give some idea of the amount of labour expended in discovery, or "prospecting," as it is termed, one of my informants stated, as the result of his experience of lead mining in Missouri and Wisconsin, that for many years past the value of the whole aggregate of lead ore raised and brought to market, would not pay one quarter of a dollar per diem for the labour employed in producing and preparing it for sale. The country being covered with a thick stratum of clay, in which the ore is found, there are no superficial indications to point out where the veins traverse; consequently the work of discovery is most precarious, and resembles a lottery, in which there are many blanks and some prizes. As some of these prizes have been very rich, and accidentally and easily obtained, the spirit of speculation has been fostered to an extraordinary extent, especially among a people so enterprising and adventurous as the Americans. For some years, every steamer brought such mine its host of visitors of every grade, allured by the ease and rapidity with which wealth had been in a few lucky instances acquired. So seductive was the employment, and so flattering the tales which hope was constantly "whispering to the ear," that nothing short of an absolute exhaustion of all their pecuniary resources could deter numbers from a further prosecution of trials which had proved utterly unprofitable. Others, who had been fortunate adventurers in the early part of their career, have spent the whole of their savings in unsuccessful "prospecting." The temptations also to squander in dissipation and intemperance the fruits of fortunate discovery, are described as being very great, so that the instances are not very numerous of persons who, like my informants, have been both fortunate and prudent. Even this class of persons have of late suffered severely, in common with every other interest in the United States, from the embarrassments arising out of monetary affairs. The suspension of payments by the Western banks seems to have paralyzed every branch of industry. The distress, commencing with the general body of consumers, extended to the merchants and manufacturers of lead, and at length fell upon the smelters and miners. The price of ore at the mines, which in the year 1837 had been so high as 13*l.* per ton, fell in the summer of 1842 to 4*l.* 14*s.*, and in the month of October last, the price had again risen to 5*l.* 13*s.* My informants were expecting a further advance, and were holding their own lead under that impression.

In the mean time, the difficulty of getting paid for any commodity in the western states in paper convertable into specie, compelled all parties to seek a market in the east, and lead was forced upon New York and other ports, more rapidly than the wants of the country required. Hence has arisen a new feature in the commerce of the United States, pig lead becoming an article of export to Europe and to China. This appears to be the true history of American lead finding its way to England. My informants state, that there is little or no increase in the produce of the mines, the quantity raised having been nearly stationary for the last eight years, the mines in Wisconsin increasing in productiveness in about the same ratio as those in Missouri have fallen off. The aggregate annual produce of the whole lead district is stated to be about 15,000 English tons. The whole of this would, in a healthy and natural state of things in the United States, be consumed in that country; and with the increasing necessities of a rapidly growing population, a progressive increase in the consumption of lead would naturally follow. This would immediately lead to higher prices, owing to the prohibition which the American tariff places on the import of foreign lead, so that a new impulse will be given to lead mining in the United States, whenever the general condition of the country recovers from its present depression.

Of late, however, lead mining in Wisconsin has been any thing but encouraging. Many of those who have saved capital, and have the means of removing, have, like my informants, left the district, either permanently, or until some improvement in its condition shall tempt them to return. Others are proceeding to Canada, which appears to hold out greater inducements to settlers at present than the United States, while some who are proprietors of land, as well as of mines, in Wisconsin and Iowa, are turning their attention to farming, the district generally being highly favourable for agriculture. This partial withdrawal of capital and industry from mining, will necessarily diminish in some degree the produce of the mines. But it must be borne in mind, that there is a considerable population entirely dependent upon them, who in the present distressed state of agriculture in the United States, have no other immediate source of employment. There are also continual additions to this class from the emigrants whom poverty has driven from the mines in this neighbourhood, as well as from other mining districts, who are but little suited to engage in other occupations, if indeed such were open to them. In this state of mining affairs in the United States, the means of making fresh discoveries are considerably crippled; but an additional stimulus is given to washing the heaps of refuse, and exploring veins which were not considered worth prosecuting in days of greater prosperity. Some facility is given to this source of production, by improved processes for dressing and smelting the ores, as also by a reduction in the price of labour, and the cost of conveying the lead to market.

These items, which enter so essentially into the cost of producing lead in this district, will necessarily aid the working of the mines in the United States; so that a lower rate of price, under present circumstances, will yield an equally good profit with the higher rate of price which prevailed when the cost of production and conveyance to market were considerably greater. My informants state, that under present circumstances, 18*l.* per ton at New York, would render lead mining in the United States a fair trade; whereas 23*l.* per ton, which has been the average price for ten years previous, has failed to produce any material increase in the annual production of the mines.

I understand that late advices from New York quote the price of lead there at nearly 18*l.* per ton, so that, if this price is likely to be maintained, lead mining in the United States may be said to have seen its worst; and whenever the prices in European ports shall rule for any length of time at 20*l.* and upwards, some encouragement will be afforded to American miners to raise lead for export; unless a general improvement in the agriculture and commerce of the United States, should cause an increased consumption in that country of its own products, at the same time that its general branches of industry would necessarily receive a higher remuneration, and thereby entail some increase in the cost of producing lead, among other commodities. At present, however, lead mining on the Mississippi has received a severe check, from which it must take some time to recover; and the produce of the mines in 1842 and 1843, will probably be found to be considerably less than that of preceding years.

Such are the impressions which I have derived from a full, frank, and very agreeable personal communication with two of my countrymen; who, to habits of industry and economy, appear to have carried great powers of observation into a country fertile in energy and unbroken in resources, although for a time suffering under causes of severe depression.

If their statements, conveyed through the medium of your valuable Journal, should be of any service to the public, I hope they will not consider the time which they kindly devoted to my information, as entirely thrown away. And if I have in my respect misunderstood their views, I trust they will give me an opportunity of correcting them, and placing them before your mining readers in their true light. I am, Sir, your obedient servant,

A Lead Smelter.

Heath, near Richmond, Feb. 7.

HYDRAULIC PROPULSION.

TO THE SUBSCRIBERS TO THE CIVIL ENGINEERS' JOURNAL.

Gentlemen,—Through the liberality of the Editor of the *Mining Journal*, and the interest he takes in the advancement of science, I am enabled to avail myself of this excellent medium for setting myself right with you in a very material case, in which I beg to submit, that the Editor of the *Civil Engineers' Journal* has deviated from his duty to you, to the public, and to myself. Every scientific periodical professes to allow of perfect and full freedom of discussion, and to put its subscribers in possession of the whole facts of any subject which it introduces, if important, and rejects the idea, as injurious to science, and most unfair to its subscribers, of giving merely one-sided statements, and of withholding communications which may militate against the views of the Editor; in fact, every respectable Editor disclaims his having any personal views or opinions of any character to advance through the medium of his publications, and professes to lay the whole of what is known or suggested before his readers, that they may be enabled to decide on what side scientific truth is to be found, the advancement of which is fully understood to be the main object which every scientific periodical has in view.

I now beg to state the following facts. The Editor of the *Civil Engineers' Journal* goes, in his December Number, a review of a Pamphlet I have published, entitled "The Hydraulic Railway." The article was replete with the most astounding misstatements of facts, and misrepresentations of circumstances. I forwarded to the Editor my answers. On the wrapper of his *January Number*, he stated the letter was "far too long to be inserted;" but in his Number for the present month, adds to the preceding intimation these words: "even were it an argumentative treatise, instead of being almost entirely discursive." Whether it merits the character he has discovered for it between the publication of his January and February Number, or whether he might have other reasons for declining to publish it, you, gentlemen, will be the best judges if you will refer to the *Mining Journal* of Jan. 14 and 28, as it appeared partly in one and partly in the other of those impressions. As regards its length, that was a necessary evil, when so many misstatements had to be argumentatively replied to. I believe it would have occupied about three and a half pages in the *Civil Engineers' Journal*, in such a type as is used occasionally in that periodical when lengthened correspondence has to appear. In the January Number, in which this letter ought to have been given, there were two articles, one of six and a half pages, and the other of nearly four and a half pages, and neither of them inserted with the important object of preserving for the Journal the invaluable and respectable character of literary fairness and honesty. I accordingly called upon the Editor to return the letter, authorising him, however, if he desired it, to take a copy of it, and I am indebted to the Editor of the *Mining Journal* for its publication since, in the manner already intimated.

The Editor of the *Civil Engineers' Journal* has, in his Number for this month, inserted an article of two and a half pages on "The Velocity of Water in Vertical Pipes," in some parts of which he labours seriously to impugn the full practicability of my system of hydraulic propulsion. As I imagined he desired his readers to understand his principal reason for rejecting my letter, already alluded to, originated in its length, I addressed a note to him on the 3d instant, requesting him to state what space he could afford in his next Number, for some important remarks I wished to make on the article on the velocity of water, &c. I desired his *early* answer, that I might so "arrange, or perhaps, curtail, my intended observations, so as not to exceed his limits." I have no answer from him; and I am, therefore, constrained, in justice to you—from whom the truth, as far as it is in his power, is concealed by the Editor of the *Civil Engineers' Journal*, in justice to the public—to whom, in the opinion of highly respectable individuals in the engineering and railway world, hydraulic propulsion is likely to prove greatly beneficial—and in justice to myself, to put the Editor of the *Civil Engineers' Journal* out of the question, and thus to address myself to you. I shall always feel proud to make my communications known to the friends of science, through the medium afforded me by the public spirited Editor of the *Mining Journal*, but should it appear more becoming and respectful to yourselves, that any communication I may have to make should be published in the same periodical in which unfriendly or other strictures may appear—and, as the Editor of the *Civil Engineers' Journal* has intimated that he shall resume the subject alluded to as given in his last; in which, by the way, he speaks neither *to* me, nor *of* me, but actually condescends to speak *at* me—I beg to state I shall forget that the *Civil Engineers' Journal* has an anonymous editor, an anonymous proprietor, and anonymous reviewers and correspondents (even when the subjects to be considered, and the spirit in which they are undertaken, demand the rejection of all disguise, and a perfectly open course of conduct), and I shall remember only the respectable correspondents, whose communications appear in that Journal; I should, therefore, on the one hand, never object to see my humble correspondence among the communications of those gentlemen, and, on the other, I should feel less concern for my trespassing, probably on other occasions, on the valuable space in the columns of the *Mining Journal*. If any gentleman should wish this, and would cause it to be notified that the columns of the *Civil Engineers' Journal* are open to my answer, to any strictures that may appear bearing on my invention, I will govern myself accordingly; if not, I must still be able all parties who may feel interested, to refer to the *Mining Journal*, in which I flatter myself I shall always have an opportunity of replying to any one-sided statement that may hereafter appear in the *Civil Engineers' Journal*; and in which the unknown writer may (for some reasons that I cannot define) endeavour to prejudice the public mind against the free exercise of their sound judgments, on the subject of hydraulic propulsion.

This explanation is long; but, after claiming some allowance for the expression of a little dissatisfaction, I can only say, in extenuation, that I felt it my duty to lay the whole of the circumstances of the case before you, as it is, almost without any exception, the opinion of all those who are well acquainted with the real nature of my invention, that the public generally should be invited to consider it, and investigate the pretensions it has upon their notice, and that all relating to it should be frankly stated. As the Editor of the *Civil Engineers' Journal* has acted so very unhandsomely in almost every respect, I shall be satisfied when I have disproved his principal allegation in the article on the velocity of water in vertical pipes, in his present Number, and shall then pass over the rest of it—in fact, when that assumption is disposed of, the remainder of the paper will become of very small importance. I now, gentlemen, solicit your attention, as subscribers to the *Civil Engineers' Journal*, to the following observations in answer to what appears to be an editorial article in that periodical.

The writer in the *Civil Engineers' Journal*, in the article I am now to consider, says:—"The final velocity of a body falling freely through sixteen feet, is, within a fraction, thirty-two feet per second; the mean velocity of the fall will, therefore, be one-half, or sixteen feet, and that, we contend, is the velocity with which a continuous and equal column of water would fall through a vertical pipe sixteen feet long, putting out of consideration the friction of the pipe, and the resistance of the air." Now, your Editor, in his December Number, spoke exactly to this effect:—"Among the best authorities in hydrodynamics, Mr. Tredgold ranks foremost." I never heard it questioned. Well, Mr. Tredgold, by his formula, given, as due to a pipe of one foot in diameter, and of the above height of sixteen feet, a discharge of 76·5 feet per second. This discharge is free, the requisite deduction for friction having been made; and yet your Editor contends the discharge will be only sixteen feet per second, and this, too, less by the friction of the pipe!! All that I can say is, that while the Editor of the *Civil Engineers' Journal* can find readers for such articles, we must go on confounding, surprising, and disgusting, and setting the laws of science, and its greatest and most honoured names, cheerily at defiance.

In another part of this paper of his, your Editor has adopted a very strange course; first, he obliterates from his recollection the question of cohesion, as it would be very inconveniently introduced, though he has just before written much in defence of it, and then he tells us, that, "were the length of the pipe greater than thirty-three feet, so that the weight of the water surpassed the pressure of the atmosphere, a torricellian vacuum would be produced"—that "no additional length of pipe would then increase the pressure"—and that "when an equilibrium is established between the column of water and the pressure of the atmosphere, the maximum effect is produced, and no additional length of pipe will add to the velocity of the flow from the reservoir." This he illustrates, by supposing a person to place his hand over the upper orifice of the pipe, when, he states, the column of water would drop, and leave a vacuum in the pipe, next the hand. How extremely puerile is this, when addressed to explain the action of the laws in operation, while a full current of water is flowing down a pipe. Does not your Editor perceive, that, in the case he supposes, *the superincumbent pressure of the atmosphere* would be cut off from the descending column, and its influence, equal to nearly 15 lbs. on the square inch, would be no longer suffered to act upon it, as it does in all pipes, both of whose orifices are open to the air. As the Editor so much prefers hypotheses to authority, even when founded on experiment and it of, I will so state to him the probable nature of the operation of the laws governing the descent of water in pipes, and preventing most effectually, to any practical length of pipe, the possibility of a vacuum.

There is over the orifice of every pipe, filled with water, and open to the air, an atmospheric pressure, equal to another column of water so placed, and of the same area as that of the orifice of thirty-three feet in height. But the rate of descent, of which this column is capable, is, if my memory serves me right, about 8·0 feet per second. With a velocity of this character, it is fully admitted this column would rush into a vacuum, on account of great pressure of the atmosphere, and of the elasticity of the fluid itself. Now, the extreme velocity imparted to this little column of water (as I may, perhaps, be excused terming it, for the sake of illustration), completely removes the possibility of a vacuum taking place in a pipe conveying a descending column of water. If any portion of the falling column, when the pipe is of great length, have a disposition to part from that above it, owing to its not only overbalancing the upward pressure of the atmosphere, at the lower orifice of the pipe, but also to its beginning to acquire a velocity, not due by the laws of gravity alone to the water above it, the superincumbent pressure of the atmospheric column throws a small part more of its force than was felt the moment before in all its efficiency throughout the whole descending column, on the volume of water, above that which might otherwise part and fall away from it, and, thus, again accelerates its rapidity of descent, and keeps it in close connection with that which is below it. It is known that a very small amount of this pressure, or other superincumbent active force, will greatly accelerate the velocity of any falling body; thus the atmospheric pressure, which is of great load, will keep firmly connected and acting together, a column of water in a vertical pipe, of very great altitude, far above what I shall require on the Hydraulic Railway. I trust all this will prove satisfactory, even to your Editor; if, however, this short explanation is not sufficient to set his mind at rest, I will only further inform him that should he prove to be in the right, and all the great philosophic minds in the wrong, I should only have to place a propulsion machine at the foot of the vertical column pipe, to take the water more slowly; in fact, to charge it along with the others at a moderate speed, when the trains were not passing. This, I imagine, he will not dispute, would effectually satisfy all his doubts on the score of a vacuum, and, I will add, it would prove a very economical mode of working out this part of the system, as a vertical pipe of nine or ten inches in diameter, would, on such an arrangement, meet all the requirements of the case.

I now turn with pleasure from the Editor of the *Civil Engineers' Journal*, and again address myself, gentlemen, to you. I hope my answer to your Editor will

prove satisfactory in either of its branches; but, let me ask, is it becoming a writer of no particular fame, particularly in hybrid pneumics, to bring forward all these ill-digested assertions—hypotheses, if the Editor like not the plain vernacular phrase—and to hold them up, with an odd species of gravity, against the united authority of Tredgold, Dr. Young, Rytzwein, Venturi, and Smeaton, for, be it remembered, that Tredgold, had the works of all these other philosophers before him, and was actually preparing a digest of them, when he brought forward his opinion, and his formula for ascertaining the velocity of discharge due to pressure given and well-defined conditions? Or, is it to be entered, that an individual should gratuitously assume that the above, as well as other philosophers, knew nothing of the nature of the discharge of water from pipes, and were in error to the extent of one half, as regards its velocity, because one distinguished individual, on one particular occasion, ascertained the character of the discharge of water through a simple orifice; and all this, too, when a more cursory examination of the works of the most eminent writers on this branch of science would satisfy any inquirer, that they carefully examined and noted the character of the two discharges of water from pipes, as well as through simple orifices.

If any party is of opinion that I have not rendered myself so clear on the subject of this letter as I have proposed to do, I will recur to it again willingly, on the objection being plainly stated. Probably, some of my readers may feel a degree of surprise at the tone to be observed in parts of this communication. On this subject I have only to observe, there are parties who have become callous to all the ordinary forms of discussion, and well-regulated modes of refutation, whose literary undertakings appear to be viewed by them merely as their tools of trade, and, perhaps, effectless as means of showing their power of annoyance, who seldom have recourse to arithmetical proportions, except to double questions of pounds, shillings, and pence, and upon whom, consequently, all courtesies of discussion would be worse than thrown away, for they would, probably, take advantage of them; and yet it does not answer to allow such parties to go altogether scot-free; it might be likely to cause them to rely still more on the brazen aegis of their hardihood. Let me, however, say, before I conclude, that if the Editor of the *Civil Engineers' Journal* ever chose to observe, in any respect, the decorums usually attendant on his position—two of the chief of which are, fair play, and all avoidance of false colouring—I shall always be most happy to treat and address him as one gentleman should another.

J. G. Smeaton.

Bath, Feb. 9.

THE SMOKE QUESTION.—MR. C. W. WILLIAMS'S REPLY TO MR. BILLINGSLEY.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—I had intended an earlier reply to Mr. Billingsley's letter, on his mode of introducing air to furnaces, but that I had to trespass so much on your columns on other matters, and only fear I shall not be able to do so within the limits I had wished.

Mr. B., in referring to my patent, appears to have confined himself to the single exemplification given in the specification, and even to have mistaken that exemplification for the patent itself, and the principle it involves. This is a common error with those who are not accustomed to consider the object for which a specification is legally required. My patent is based on two distinct principles or conditions—viz., 1st. The providing an adequate supply of air to the inflammable gases evolved from coal in furnaces, distinct from the supply which is required for the solid carbonaceous or coky matter resting on the bars; and 2d. The so introducing such air to those gases as to effect their intermixture *within the proper time*, that is, while they retain the required temperature for chemical action—such being the *sine qua non* of their combustion. The mode, or means, which constitute the improvement, and embodiment of those principles, consists in causing the air to enter the furnace, and come in contact with the gaseous matter therein, in a divided, or distributed, state, by passing it through certain apertures, the mechanical effect of which is the producing a quicker and more intimate mixture, or diffusion, between the atoms of air and gas, and, consequently, a greater amount of chemical union and combustion. This combined mechanical and chemical operation is strictly analogous to what is effected by the principle of the Argand, or bat's wing gas-burners.

In the specification of my patent is given "one of the modes" in which the principle may be carried into practice. Mr. Billingsley, however, applies himself to that single illustration, overlooking the main object of the patent, with reference to which the specification is alone to be considered. Mr. B. says, of his own mode of admitting air (and which, I allege, is covered by my patent), "I have employed a rack, or trellis," and then adds, that such "does not act in the capacity of supplying either jets or flues, or as an air distributor; but simply as a *valve*, for supplying or shutting-off the air, as may be necessary." What Mr. B. intended it should do, is one thing; what it *really* does, is the question; and that gentleman will, on reconsidering the question, perceive that it necessarily must divide, or distribute, the air into as many flues, or proportions (call them what we may), as there are divisions, apertures, or entrances, in his distributor trellis. But if this apparatus be really not necessary, as he informs us, I would ask why he uses it? Of what use are those numerous apertures, but to divide the air into so many flues? A single orifice, with a sliding-door, would be a cheaper and better *valve*, if the mere supplying or shutting off the air was the desideratum. As to the "focal bridge," until Mr. B. explains his meaning, and the effect, mechanical or chemical, which it is designed to produce, I must consider it as a mere blind, to draw attention from the main point.

Mr. B. observes, "Mr. Williams cannot be ignorant of the *fact*, that if the air was admitted through 1000 holes (in the situation my rack is placed, about three feet from the grate-bars), it would not enter the gas in jets, but in a body of greater or less density." I beg to assure Mr. B. that his "fact" is no fact at all, and that he is entirely mistaken on these points; and that even the distance he alludes to actually assists the operation, of which I have had abundant proofs. The idea, however, that the air, entering through 1000 holes, would not produce 1000 jets, divisions, or streams, and, instead of being divided, would only produce "a body of a greater or less density," is entirely opposed both to practice and chemistry. If this were the case, then all that Dalton has written of diffusion and the mixing of gases, or uniform bodies, and that Graham has subsequently illustrated, is but error; and the scientific world would still have to be set right on this point. As well may we be told that the gas issuing from the sixteen holes of the Argand burner does not issue in sixteen streams, but only in "a body of greater or less density." As well may it be asserted that the water issuing from the 1000 holes in the rose of the watering-pot does not issue in so many jets or streams.

The air entering the furnace through 1000, or any other number, of orifices, is divided, or distributed into just so many portions, giving a corresponding increase of contact, or mutual surface action (the great desideratum), with the gases inside; whereas, if the same quantity of air were introduced in one, or more, large portions, masses, or streams, it would retain the same character and body, and remain unmixed with the gas, *until too late*—that is, until both air and gas had passed, unincorporated, into the cooling influence of the flues, and had been cooled down below the temperature of ignition. If the air, entering through these 1000 holes, entered a perfect vacuum, the case, as put by Mr. B., might have some weight; but entering a furnace chamber, filled with gases, combustible and incombustible, and with which it has a powerful affinity and tendency to combine (and the supply of which gases is unremitting *as long as the fuel lasts*), the idea of those 1000 streams of air resisting this tendency to combine and become diffused, and on which Dalton's whole theory is based, is too monstrous to be dwelt on.

It is manifest that Mr. Billingsley has looked alone to the "one mode" of effecting the purpose described in my specification, while he has avoided noticing the chemical principle which it is intended to reduce to practice. Yet the specification goes elaborately into the explanation of that principle, without reference to which, indeed, it cannot be understood. He dwells on the number, size, and situation of the orifices, as if these were the objects of the patent; yet nothing can be more explicit than the clause stating the common sense view of the subject—that "I am not confined to their particular number, division, or situation."

In the argument on Neilson's hot-blast patent, Baron Alderson observed, "I take the distinction between a patent for a principle and a patent which can be supported is, that you must have an embodiment of the principle, in some *practical mode*, described in the specification, of carrying the principle into actual effect, and then you take out your patent—not for the principle, but for the mode of carrying the principle into effect." In conformity with this reasoning, I allege the principle to be, that air, introduced in a divided state to the gases in a furnace, causes a more efficient mixing and diffusion than if brought in through large orifices or in large streams: then, the practical mode of embodying that principle is, the causing the air to enter by means of an apparatus, by which it is divided, as the gas is divided by the Argand burner. Again, that learned judge further observes of Neilson's patent:—"The blowing apparatus was well known—the heating of air was well known; then, what he really discovered is, that it would be better to apply heated air [so I may divided air]—that is the principle—that is the real discovery; but, in order to take out a patent, you must have an embodiment of the principle, and his embodiment of the principle is the heating the air in a separate vessel, intermediately between the blast apparatus and the furnace;" then, he says, "I do not mean to claim any shape in which it is done—it may be done in a vessel of any shape—provided only you have such a vessel, of such a shape, and fire so applied, that the air arrives at a red heat." Now, to apply these words, I say, my specification alleges the advantages of applying air, in a *divided* state, to the gases in the furnace, instead of entering in large masses or streams. That is the principle—that is the real discovery; and the embodiment of that principle is the passing the air to the gases in the furnace through the apertures of plates, pipes, tiles, or other apparatus, called "distributors," by which it shall be divided, or distributed.

Again, in the same case, Lord Abinger says—"It proposes to apply air by making it pass through some medium by which it will acquire heat before it enters the furnace. A *particular form, or shape, or medium, is no part of the patent*; but it is, that air shall pass through a heating process before it enters the furnace;" and, further on—"the particular mode in which it is to be heated, I leave to you; my discovery is, that it shall be heated by passing through a heating process before it comes to the furnace." These words are so precisely and strictly in point, that they need nothing to show their application to my specification. By using the word "dividing" the air, instead of "heating" it, the whole is as applicable to my patent as to that of Neilson. Unwilling to occupy too much space, I beg to be allowed to conclude these observations in my next.

Liverpool, Feb. 1. C. W. Williams.

INFRINGEMENT OF PATENTS.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—Permit me to say a word in reply to "A Patentee," in your last Journal. "A Patentee" mistakes, or mis-states, the "dispute," as he terms it, between me and Joseph Williams, and though the "law of patents" is not concerned in the matter, the rights of patentees are deeply involved in it. The question I have raised, as regards Joseph Williams, is, how far that person is authorised, under pretence of carrying out Kurtz's patent, to depart entirely from it, both in principle and practice, and to range through the patent list, adopting the principle and practice of those which may appear to answer his purpose? This, Sir, as you have observed, involves a question "of general interest," and against such a proceeding every patentee is, in self-defence, called on to protest.

The question of an alleged infringement of my patent, being a merely collateral one, and of a personal character, I will not here go into it. I may, however, allude to your former editorial remarks, in which you observe on the minute difference between that introduced into the *Urgent* and my patent. In that, Sir, I entirely concur—the difference is, indeed, minute, if, in fact, there be any. That, however, is not the question in which the public are concerned, which is this, whether the plan introduced into the Admiralty packet, the *Urgent*, is Kurtz's patent, or in any way approaching to it? Will "A Patentee" direct his attention to that point? Will he examine the diagrams, Nos. 1 and 2, in the Journal of the 28th ult., and candidly say if there be any resemblance between them—in what that resemblance consists—and in what respect they differ? and, further, whether an individual passing off the latter, No. 2, as Kurtz's patent, is to be justified, much less defended, by any man professing to have mechanical judgment, or in the class of a patentee. Indeed, it will be seen, by inspection of those diagrams, that he has even laid aside that which would give a claim to the use of *hot air*—viz., the hollow bearers and side-heating passages. As to any action at law, most assuredly, it is not against such a person as Joseph Williams that any sane man would proceed. The bit of harmless defiance, as to bringing the question before a jury, is a mere bait, to draw attention from the real matter at issue, and seems to have caught "A Patentee." In the present case, it is worth observing, that those who would, if they could, defend Joseph Williams, confine themselves to nibbling at minor, and even unimportant, points, while they carefully abstain from grappling with the main charge.

Liverpool, Feb. 9. C. W. Williams.

SMOKE-CONSUMING FURNACES.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—The tedious and interminable "smoke discussion" occupies so much space, week after week, in your columns, that it must be evident to every one, that you feel a deeper interest in the subject than that of settling the claims of those uncourteous disputants; but, as the fact of the smoke-consuming furnaces working effectively and economically now seems to be well established, it would be far more satisfactory to your numerous readers if you would endeavour to ascertain and explain to them the simplest and cheapest construction to accomplish this desirable result. Every morning, on my way to business, I pass several large steam-engine chimneys, all vomiting forth dense clouds of black smoke, and yet we have no less than two of the smoke-preventing patentees in this very town, and a corporation professing some regard to the comfort of the inhabitants. The all-important question is, not who invented the remedy, or whether it should be accomplished by hot air or by cold air, by small jets, by hollow fire bars, by Williams, or by Hall, but really and truly, whether it is to be accomplished at all, in any general sense. You, Mr. Editor, I am glad to say, are often successful in eliciting good sound practical information from your correspondents, by your judicious remarks upon their communications. Could you not hint to the "smoke-curing" gentry, that it would serve their own interests better, if they would point out the best mode of proceeding against the "tall chimney owners," so as to compel them to adopt some one of the successful patents. The public would, I am sure, feel an interest in that view of the question. E.

58, *Bedford street North, Liverpool, Feb. 6.*

ON THE FORMATION OF MINERAL DEPOSITS.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—Your Oxford correspondent is inclined to quibble, and make a display of my ignorance, rather than meet my plain practical facts. He says I commit an act of injustice to the scientific portion of the community. Now, Sir, I beg leave to say, that no person, in correspondence with your excellent Journal, admires scientific knowledge more than I do; but I know how to make a distinction between such men as Davy, Watt, Arkwright, Fulton, Eli Witney, Smeaton, Telford, Brindley, Stephenson, and Brunel, and a great many other worthy characters, that have been useful to the arts and sciences in our own and other countries. Who ever heard of those exceeding useful characters named above talking about how and when coals and metals were formed, and telling us the earth is still in an unfinished state! What do you suppose Watt and Arkwright would have said to any person that had told them what "J. S. D.," from Oxford, has told us in your last week's Journal. He tells me, I am welcome to think the world is made (that is, finished), but men of science know that the world is making—that mines, rocks, and earths, mineral beds, and veins, all are continually being made or created. "J. S. D." says, every day there is something new under the Sun—by that, I suppose he means a change is taking place in mines, rocks, earths, mineral beds, &c. Let "J. S. D." produce one single fact in proof of his assertion, if he can—I dare him to do so, in any of the stratifications of the earth. I know the coral insect labours to an effect—petrifaction is in action—and, perhaps, crystallisation; but these form on part of the stratified portion of the earth. As nothing short of facts will do, if he has any proof of what he has so confidently advanced, let us have it. I produce facts, and, if I mistake not, those facts have puzzled the schoolmen. He says a little learning is a dangerous thing—I know it is, especially if there is, assumed, a little practical knowledge with it. I have seen it exemplified round about this district. I have seen many of that character come puffed up with their school knowledge, and wherever they have been trusted with management, have strewed the road they have walked upon with ruin, and little children are now feeling the effects of it. I have witnessed their doings, and I can tell their names; one of them told me once, the same as "J. S. D." tells me, that I had no scientific knowledge; but, if I had no scientific knowledge, I had, as far as regarded him (and many others of the same school), prophetic knowledge; for I foretold him what actually did come to pass; and, no doubt, your Oxford correspondent thinks nothing scientific can be acquired without school knowledge. Look at those worthy names I have mentioned above; the greater part of them were so limited in school knowledge as myself—no doubt, "J. S. D." had he lived in their day, could not have supposed anything scientific could ever flourish out of some seminary of learning. It is surprising what fanciful notions are advanced upon the formation of coals, metals, &c. Why don't some of them turn their attention to some other works of Creation? Why always harping upon the same string? Why don't they tell us how the rocks are formed? how the magnificent limestone rocks are formed? how the old red sandstone was formed? which I have proved myself 1500 feet in thickness, and I did not find the bottom of it; therefore, how much thicker it is I don't know; the great thickness of which Providence made and intended it to spread over a very large portion of the surface of the globe, than of which I know no soil more suitable for tillage, vegetation, and usefulness, to man and beast. Why are coals, ironstone, and limestone, placed within reasonable distances of each other, but to show (no chance work) that they were intended to produce iron? Why are the best situations (and, indeed, are generally chosen for the purpose), or sites, for large iron-works, on property the surface of which is of very little value (I know there are exceptions, but they are rare)? This all shows that the arrangements were made before iron was made—no chance here. Why does the stratification of the earth incline, and why is that line of inclination pointed to every figure of the compass? Why do those inclinations, some rising here and others yonder, bring to the surface a suitable soil to vegetate for the subsistence of man? and why do those upthrows and rapid croppings out of the strata bring up to the surface the middle formation of the earth—a stratification producing tin, copper, and also the precious metals—silver and gold—and every other metal, the ores of which, in many districts, are buried a mile deep in the earth? This is all for the use of man (no chance); the man that tells us how the minerals were formed, should tell us more than that—he should tell us how the accompanying strata was made also; because, it appears to me, as great a piece of workmanship to make the accompanying strata as to make the minerals—they should tell us why the earth's strata was not placed level, and every lamillation of strata to be found everywhere, except where valleys intervene. Don't they know that such a formation of the earth would not do for what the Maker of the earth intended it, whose all-wise designs are manifest? What would the great agricultural countries do if they were pestered with iron, copper, tin, lead, gold, or silver mines in them (I say, again, there are exceptions in this rule, but they are rare)?—Why, the agriculturist would not want them there, and the Maker of the universe knew that. Why are the materials for making iron most abundant in cold countries?—Why, because such a climate is best suited for making iron. Why are not earthquakes or volcanoes found in coal formations (which they have never been), so as to derange the strata?—No, the volcano has its proper place in the earth's formation. Why don't those geological gentlemen sometimes turn their attention to inquire how trees and vegetation were made—how so many species of each are produced by the same soil? These things would not suit their purpose—these surface things would be open to the judgment of all men—there could be no mystery; thus we have such foolish notions taken up with regard to coals and metals.

Thomas Drakin.

Blaenavon, Jan. 31.

ON THE ORIGIN OF GOSSAN.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—In the numerous letters which have recently appeared in your valuable Journal, on the origin of mineral veins, I do not find one touching upon this very important material. Gossan is supposed by many practical mineralogists to be formed from the decomposition of iron pyrites, being chiefly found to accompany veins in which this mineral abounds in its altered, or supposed altered, state. Its general components are quartz and brown oxide of iron and ochreous earth, constituting the crowning deposit of the mine, and sometimes abounding in the mine itself, forming the back of copper lodes, and disseminated in veins of silver, quartz, chlorite, and other bodies. The appearance of gossan in large mining districts, and particularly in Cornwall, is hailed as a happy omen of what is to be expected beneath, and long experience has taught the miner in this and other countries that it is an unfailing indication of an abundant crop beneath, and not very far off, as connected with the generation of metals, and the enrichment of veins, the causes of its present disposition, and origin, demand our most serious consideration. Mineralogists are, probably, right in their conjectures, for, most certainly, appearances warrant the conclusion, that it takes the place of iron pyrites; but in this we must not generalise, for other phenomena testify, in as strong a manner, that it is very often simultaneously produced with the iron pyrites. In Cornwall, granite is often found in a soft state, and may be observed in its various stages of induration; this has given rise to the question, whether the crystalline body has undergone decomposition, or whether it is advancing to its consolidated state? Geologists, one and all, lay down the law, that it is decomposing; but I hold, that, although some few instances of decomposition have taken place, in general the granite is slowly progressing to the consolidated state; and, as a proof of this, no sooner does it become exposed to atmospheric air than it consolidates. The origin of gossan is much the same; in some instances it is formed from the decomposition of iron pyrites—in others it is produced by the chemical action going on beneath. The decomposition of iron pyrites will not account for the immense quantities of quartz common to mines, even in the absence of brown oxide of iron, although it may account for the appearance of the latter, nor does it appear essential to the formation of quartz, which must have been simultaneously produced with the metalline ore, and, in many instances, it is produced previous to the deposition of the mineral matter, being, as is evidenced, the recipient body of the aqueous or vaporous exhalations of the metal united with sulphur. Quartz, spar, fluor, and hornblende, give reception to all metals and ores, slates, chiefly to copper and silver, but never to tin, and mica to iron; two or more of these materials, with chlorite, sulphur, arsenic, and other bodies, compose the general admixtures, distinguishing the gangue, or vein stuff of mineral veins, intersecting the solid rocks and beds of the earth; and are exclusively the recipients of the metalline body, no matter if the latter be derived from the bed in which it is deposited, or from contiguous strata. The quartz of gossany beds has generally a perfect freedom of development, denoting the absence of all lateral pressure, and the presence of water, which, while it admits the expansion of bodies, furthers and assists decomposition and re-combination of all compounds disposed within its medium. The gossany soil crowning copper mines in Cornwall, and other places, is generally of a loose porous texture, subject, in this respect, to much local variation, but always developed with greater freedom than is manifest in beds containing iron pyrites. It appears evident to me, that gossan is formed with the forming metal, and, in the generality of cases, contemporaneously with the metalline body with which it is blended; that in the chemical decomposition and re-combination of the material composing the mineral veins, vaporous exhalations pass upwards, and, blending with the surface material, cause like changes and re-combinations, in which, as is common in the silver mines of America, the metal will sometimes pass off in its vaporous state, and unite with the gossany bed; that when iron pyrites decompose on the surface of the earth, the oxide of iron is produced, but the sulphur passing off into the atmosphere, becomes dissipated, being lost in ultimate separation of parts; that the soft and ochreous species of gossan is, with few exceptions, the most productive, although, at times, the quartzose variety accompanies the richer deposits of ore. It can scarcely be supposed that the mine owes its quality or quantity of mineral to the gossan; the mode of its formation appears to be precisely similar to the formation of iron pyrites with which it is blended. Cenio.

Feb. 7.

ON THE FORMATION OF MINERAL DEPOSITS.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—The question between scientific and practical geology (as it is called) is still agitated in your late Journals. Your Oxford correspondent, "J. S. D.," seems to mistake the meaning of Mr. Thomas Drakin, about the hearts of scientific men in assisting the practical miner. No man ever would be so mad as to deny, that Sir H. Davy, with chemistry, and Mr. Watt, with mechanics, had not *materially* benefitted the mining community. But that is *not* the question of Messrs. Drakin and Co. they ask, what has *scholastic* geology done for the miner? This question is not so easily solved. We do not depreciate learning in any science, but rather commend it in all. Neither do we imagine that scientific geology is without interest and profit to the miner; yet the profit so far has been, we imagine, very small. To investigate this more fully, let us briefly look into the case. What, then, is to be understood by scientific geology? It seems to embrace the following:—1. An accurate knowledge of the mineral masses, so as to be able to classify them into so many groups, or formations, such as primary, secondary, tertiary, &c., &c. 2. The knowledge of the mode of those formations, as they can be accurately deduced from the changes now apparent. 3. It presumes to account for all those interruptions which have taken place, and are now taking place, in the earth's crust. To arrive at the knowledge above alluded to, we are aware other topics will come under review, yet only so, as they may lead to the above. Practical geology, or let me call it the *art of mining*, is quite distinct from the above. It has its doctrines and data, but these have been gathered from experience chiefly. The miner knows generally his own ground, and when interruptions are met, he inquires not so much

about their origin, as about the best mode to meet the enemy. The scientific geologist does classify the strata, tell occasionally their chemical character, and by maps may show their locality, as well as the course and position of the interruptions met with in them, but tells nothing about the mode of obtaining, or method of using, any of them, nor the method of overcoming those obstacles to be met with, in extracting them to advantage. How then can the miner benefit by scientific geology, unless it assume another form? We fear it speculates rather too freely; and, surely, there is no want of bold presumption in many of the conflicting systems abroad in the world. We, ourselves, peruse with pleasure all that has been written on this fascinating subject, yet, with caution, we would receive many of its speculations. We imagine in this, as well as other sciences, there are boundaries that we cannot pass, and certain limits that defies man's bold approach. We are quite aware that knowledge is power, and that the scientific have, in consequence, large resources at command, yet even they may misapply that knowledge, as did your correspondent, "J. S. D.," when he said, certain rocks were now creating, or being created. By creation, we generally mean one instantaneous act of omnipotent power, in bringing into existence that which was nought; I hope your correspondent will excuse me in this. I am quite aware, that by a superintending Providence certain *formations* are now going on in the earth; but not *creations*. I am afraid, lest many of our scientific gentlemen imagine, that matter is self-acting and eternal; and, no doubt, this led one to keep out of his writings the word create. But more of this again, or, at least, the course of induction commonly pursued by geologists generally.

U. THOMPSON.

Cwm Avenon, Feb. 1.

ORIGIN OF MINERAL LODES.

TO THE EDITOR OF THE MINING JOURNAL.

SIR,—I am gratified to find that your correspondent, Mr. Budge, has broken ground in so able and workmanlike a manner, identifying his ideas with one of your ablest correspondents. In the rocks and stones of mines, as he truly observes, we have the mimic representations of Nature in her grandest efforts, every foot being intersected by veins and cross-courses, and all the beautiful phenomena which have given rise to so many conflicting theories and opinions, and if this practical miner will extend his observations beyond the confined boundaries marked out by himself, he will find the like phenomena formed, and still forming, in clay, calcareous, and even sand beds, ere the comminated particles become united as one ponderable body. In a bed of clay, as the moisture departs, the calx separates within the aluminous matrix, in veins such as described, taking the direction given by the primary disposition of this body, uniting its volumes in the line of action, in like manner as is observed in the first formation of the organic frame of the chicken within the egg. Excess of silica in the clay separates from the latter in like manner, these veins increasing as the aluminous earth consolidates its particles, the general contraction of the one giving the necessary room for increase of the other. In a bed of calcareous matter, when the whole mass is in a state of decomposition, this very natural arrangement takes place, the heavier fluids percolating through the lighter particles, and settling in veins, cross-courses, &c.; thus, there is scarcely a foot of marble but we find curiously veined and intersected. Again, in cavernous structures, these operations of Nature are manifest, the silicic acid percolating through the consolidating bed, until, meeting with the atmospheric air, the hydrogen is abstracted by the oxygen of the atmosphere, and the exuding matter becomes an indurated body, termed stalactites. I remember while in Egypt, some years ago, entering one of the catacombs open to atmospheric influences, and being struck with surprise to see even the chiselled walls covered with a beautiful glassy coating of quartz, resembling the close cuttings of a wine decanter, all parts of the limestone mass being covered with it, but the interspersed chalk formations wholly exempt from it; this and many other illustrative facts which I could adduce tend to show that commingled matter, in its decomposed state, is willed in its disposition and union by the laws of chemical affinity and specific gravity, and that the form assumed depends upon the primary disposition of the elastic bodies, as well as upon the nature of the action manifest. Waters overlying the earth, and percolating to the inner beds, are often charged with matters which they carry with them into these beds, and these uniting with the material of the inner beds, induce chemical action and consequent change. Mr. Budge supposes that the veins and the rock were simultaneously formed, but the real fact is, the lode was formed ere that which is now rock had consolidated, the forming of the lodes being proximate causes of consolidation of the whole. Again, the mineral lode thus formed is not necessarily, and in all cases, metalline, for, although the metals are evidently generated within many beds, yet is it certain that the gangue of many of the veins has become the recipient of the metals which, carried therein, in their seriform or fluid state, have been precipitated, together with the bodies with which they have been held in combination, or they have been retained by the force of affinity of the vein stuff to the metals. Again, as is supposed by many intelligent miners of Cornwall, the crude immature material of the lodes nourishes and feeds the ores with which they are intermingled, and by this means ores are generated, the nature of the one determining the nature of the other, for many veins yield the strongest evidence, by the presence of ghur, of ores having been there conceived, and not carried thither and deposited in their present state, and, as is truly remarked by a learned writer, their regular unbroken appearance, their accretion to the contiguous rock, either by accretion or by invention of a matrix, the regular appearance of this matrix intervesloping the ore; the frequent crystallisation of the one and the other contents of the vein indicate that ores, as well as the other solid contents, have there concreted from a fluid to a solid state: still, as previously observed, there are many exceptions to this general rule. Mr. Budge will please to observe, that there are many highly scientific men who agree with him in the contemporaneous formation of the metallic lodes, and the matrix which incloses them, as above expressed by me, but it is a great perversion of common sense, to suppose that the earth is now as it was in the beginning, unchanged in its parts, quantities, and qualities, and there are few observing miners, but contend for the generation of the metals; the intrusion of water alone from the surface of the earth must occasion a great change in the physical character of mines and minerals; and there is, in numerous cases, direct manifestation that fissures have been formed by excavation, but that many veins are channels made through the strata while yet in its soft state, by water, or by the more fluid parts of the strata penetrating and forming a passage through the more solid parts, such fluids conveying thither metalline principles, or bodies, which, uniting with the material of the lode, are the auxiliary agents of change, or conversion into the metals. It is a well-known fact, that the prevailing material of the vein stuff is silica, or silica in union with alumine—heavy fluids, which readily percolate through yielding porous strata; it is equally well known, that there are veins of pure metal intersecting solid rock—that metals are conveyed in their seriform state from the primary vein towards the upper surface of the earth—and there uniting with various bodies, yield indications of ores; these and other phenomena tend to show that the operations of Nature are various, and that no theory can be laid down for the generation or disposition of metals or mineral deposits.

Feb. 1. OBSERVER.

ON THE FORMATION OF MINERAL VEINS.

TO THE EDITOR OF THE MINING JOURNAL.

SIR,—"A Collier" states that "A Workman" has suddenly plunged headlong into theory; if so, perhaps I ought to beg his pardon for having made the stumble. It is well to have an "old friend" to help one out. He says, "If we are to theorise, I presume we can do so in a much more rational manner." To which would he wish to have this bold assumption attributed—to his vanity, or simplicity? "A Workman's" letters, from first to last, were to the nature of evidence, and nothing more, in support of theories heretofore advanced, and which it was sought to refute by rapid declamation and dogmatic assertions, without a tittle of either reason or argument: and that those letters constituted in the character of a witness, rather than that of an advocate, I need only refer to "A Collier's" letter (although I might, also, to others). In the concluding sentence, he says, "'A Workman' should now bring forward supporting facts, known to every practical miner;" this, surely, he would not expect, if he believed his own assertions, that "A Workman" had a main object to establish. But why not, himself, bring forward the opposing facts, as his "own experience proves?" and not be like a naughty school-boy, who says, "I know something, but I'll not tell you;" and whispers out, "Let Jim tell, if he likes."

A WORKMAN.

Littleton, Feb. 1.

[For continuation of "Original Correspondence," see p. 40.]

DEFRIES' PATENT DRY METER.

Fig. 1.

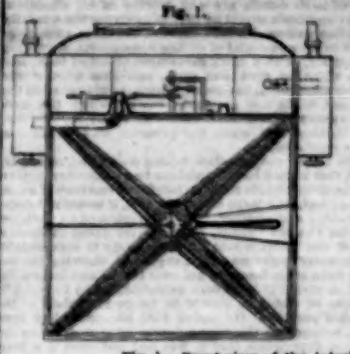


Fig. 2.

Fig. 1.—Front view of the interior of the meter.
Fig. 2.—Top view of the interior of the meter.

This meter contains three flexible partitions, or diaphragms; and the gas, entering into the meter by means of the inlet-pipe, passes through a circular ring into the valve-chamber, from whence it descends into the flexible partition below. The gas passes on either side of these partitions, until the levers in the upper part of the meter are brought to their full extent; this produces a change of valves, and the current of gas is reversed; and so, by an alternate change of the valves, a constant and equal supply of gas is kept up. The great advantages of the dry, over the wet, meter, are—the impossibility of any loss, either to the consumers or gas manufacturers, by the variation of the water-line, from condensation or evaporation; the impossibility of the meter being spoiled by the action of frost, as is the case with the water meter; and, when the dry meter is once made to register correctly, it must continue to work so long as the materials last. Tilting, either on one side or the other, makes no difference in the registration; nor is it possible for the gas to pass through, as is the case in the wet meter, without registration.

BOTTEN'S PATENT PROTECTOR METER.

PATENT GRANTED JUNE, 1841.

The merit claimed on the part of the patentee of this meter is, that of having overcome entirely, by a most simple contrivance, the objections made to the old water meter, on the ground of variations in the water line. It is impossible to overcharge this meter to the prejudice of the consumers, for, as soon as there is the smallest surplus, it is carried off and discharged before it can interfere, in the least, with the going of the meter. The inlet pipe, A, and the outlet pipe, B, are the same as those of the common meter; but the water, after entering the case of the meter through the pipe, C, passes from thence into the square box, V V V V, in front.

Fig. 1.

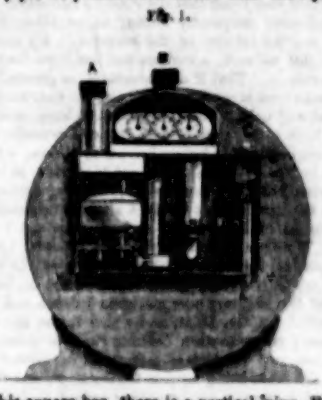
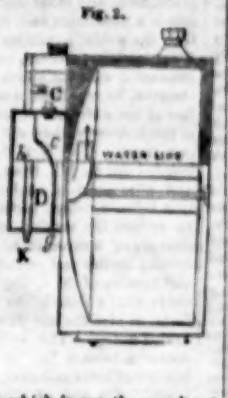


Fig. 2.



In this square box there is a vertical pipe, E, which is exactly on a level at the top with the proper water line of the meter, and opens at the bottom into a side chamber, D, containing another vertical pipe, b, which rises also to the exact level of the water line, and is open at bottom, K, to the atmosphere. The moment the water in the square box rises above its proper level, the surplus passes over into the vertical pipe E, whence it flows through G up the side chamber D, till it reaches the top of the vertical pipe H, down which it escapes out of the meter altogether.

Extract from the Specification.

Whereas it is requisite, in order that gas meters should register correctly the quantity of gas which passes through them, that the water in them should be maintained at a certain fixed level, but that, according to the mode in which they are now ordinarily constructed, the height of the water line is constantly liable to variation, sometimes from the removal or imperfect action of the float, which should close upon the gas inlet valve when the water falls below its proper level—in which case the quantity of gas registered is too little, and sometimes from the introduction of an excess of water, in which case the quantity of gas registered is greater than that which actually passes through, in proportion to the excess of water introduced. The present invention consists in constructing gas meters, with such additions, that the water may always be kept with perfect certainty at its proper level (loss from evaporation always excepted), and that, should any excess of water be introduced, such excess will overflow into a waste or discharge pipe, without affecting in the least the said level.

EDGE'S IMPROVED GAS-METER.

PATENT GRANTED NOV., 1842.

Fig. 1.

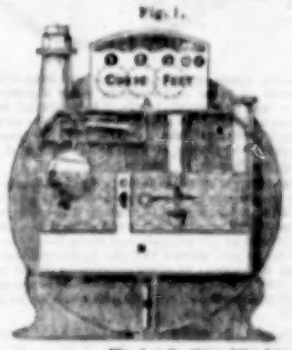


Fig. 2.

Fig. 1.—Section of the front of the meter.
Fig. 2.—Side section of the meter.

a represents the patent index, which enables the inspector and the consumer to ascertain the quantity of gas used, with ease and certainty. The figures revolve instead of the hands (as in the old meter), and, as only the figure required on each plate can be seen at a time, no mistake can arise; *b* represents the patent lever valve, the object of which is to prevent the numerous complaints of the consumers, and the very heavy losses to the companies, by the lodgment of the old valve, consequent on the corrosion of the guide wires; this lodgment can rarely, if ever, be proved by ocular demonstration, as the slightest movement will cause the valve to fall into its seat—but still it is proved daily, and beyond all question, by a disturbed registration; and it is not the less objectionable, as an evil, for being a secret and invisible one. Every gas company in existence may be appealed to in proof of the dispute (frequently serious ones) which occur with the consumers, in consequence of a variable registration. The consumer refers to one or more quarters when the meter has, in truth, registered less than it ought to have done (owing to this lodgment of the valve), and he insists, whenever the real quantity used is shown, that it (the gas, that it has got out of order, and has become a false and deceptive instrument. The lever valve completely and effectually remedies this; it also indicates a deficiency of water much earlier than the old valve, and the shield protects it at once from any sudden rush of pressure, and the acts of the dishonest consumer; it may, in fact, be considered perfect in its action, and unassailable on every point. *c* represents the patent syphon, and *d* the waste water chamber—the value of which two improvements cannot be over-estimated, for, in the first place, they remove the only dangerous part of the meter—viz., the outlet from the syphon pipe, which is now sealed off; in the second place, they prevent the fraudulent abstraction of the water, to the serious injury of the company; and, thirdly, they prevent the accumulation of the water, by which the consumer is deprived of his full measure. The top of the syphon pipe being placed on a line with the water level, every surplus drop must fall into it; and as the passage of the gas will be entirely stopped before the water fills the syphon, it is evident that the action of the meter must entirely cease before there can be the slightest excess in the meter itself—consequently, it serves as a protector alike to the consumer and the company. It will be observed, that there is only one outlet screw instead of two, as in the common meter, and the removal of this screw, *e*, will at once show whether the stoppage arises from the closing of the valve, or from the accumulation of water in the syphon pipe, and will lessen the occurrence of mistakes by persons not thoroughly acquainted with the old system.

GAS-METERS—ROYAL ADELAIDE GALLERY.

On Saturday evening last, Mr. Jones (the proprietor) delivered the 87th lecture on the fallacies of gas meters. The lecturer stated that the object he had in view that evening, was to show more fully than he had yet done, the variation to which the gas meter was liable, and to state the result of the recent public investigations which had lasted nearly twenty hours, and had been conducted in the premises, and with the assistance of, a large number of gas-meter manufacturers, and parties connected officially with gas-works. The meter was said to be in working order, when the water is at the level line; now, if the meter, either from condensation of the gas itself, or from being surcharged by the inspector, or any other person, had its water above that line, it registered that extra quantity of water, instead of gas, to the detriment of the consumer. On the other hand, if the water sunk below that line, supposing the meter to register correctly, which was seldom the case, the company was the sufferer. But the wet meter was liable to many objections besides this variation of the water line, for, if tilted up from the front, the water would rise in the posterior chamber, and tell against the consumer, and, if tilted from behind, the water would rise in the anterior chamber, and tell against the company, or, if sufficiently tilted, would let the gas pass without registering at all. All parties allowed the wet meter to be a most ingenious machine, and it was capable of being made, so as to measure correctly at its level line of liquor to any standard. Why is not this done always? That question he would leave to be answered by others; observing, however, that it was not done, and facts would bear him out, in asserting that meters were not made to register accurately to any one standard. A variation has been found in water meters from different makers, and for different companies, at the level line, and when this fact is taken into consideration with another—viz., that the water meter can be made to register correctly to any standard, it was a legitimate inference that some controlling influence was required to be exercised in the matter by a disinterested and properly appointed person. Besides this original variation of the level line, the meter was liable to great inaccuracy, from evaporation, difference of pressure on the gas, and the improper adjustment of the meter itself. Water accumulated from two causes,—first, from the aqueous vapour, which accompanied the gas from the works being condensed into water in its passage through the meter; and, secondly, from the running back into the meter of the water, which accumulated in the fittings by condensation. In addition to this tendency to accumulate water, the meter was often surcharged with water from a mistaken notion, that a much greater quantity than was really required, was necessary to enable the lights to burn. And here he might repeat that the presence of water above the level line diminished the capacity of the gas measure, and gave the consumer an incorrect registry against himself to an amount varying—according to the quantity of water present—from 1 to 35 per cent. He would detail the results of experiments made both publicly and privately, in proof of what he asserted. The first was with an experimental meter with the water at the level line with a pressure of 8-10ths. The result was 5½ per cent. against the consumer, who, by the meter in question, would be overcharged 5*l.* 10*s.* in every 100*l.* Two pints of water were added above the level line, and the meter registered 32 per cent. fast, or 32*l.* against the consumer in every 100*l.* of gas he would be charged for with the meter thus filled with water. Another experiment—made publicly—was with a ten light meter, manufactured by one of the best makers in London. This was fully charged with water, or as much as it would hold above the level line; and with a pressure of 8-10ths on the inlet, and 5-10ths on the outlet, it registered, with good lights, 22½ per cent. against the consumer. The water above the level line was then withdrawn, and was found to be two quarts and one-eighth. Besides this, it was seen that when the meter was tilted forwards, and the water, to a certain extent, drawn off, the gas passed through the meter without any registration whatever taking place, so that while by filling the meter with water, the consumer might be overcharged to the extent of 22½ per cent., the company would, if the meter were tilted up an inch or so, and the water drawn off from the under syphon and the side plug, be supplying gas for nothing. Another experiment was then tried with the meter. Twenty feet of gas were passed through it at the level line, with a pressure of 8-10ths on the inlet, and 5½-10ths on the outlet. It proved to be 9½ per cent. fast; or, in other words, it would occasion the consumer to be overcharged 9*l.* 15*s.* on every 100*l.* An experiment was then made with the meter, for the purpose of ascertaining what protection it afforded the company against the public, or rather to see how much water might be taken out of the meter from below the level line. Gentlemen would recollect that this meter, when two quarts and one-eighth of water were poured in above the level line, registered 22½ per cent. against the consumer. The water having been brought to the level line, half a pint was withdrawn, and the meter then went slower by 1½ per cent., still leaving it 21 per cent. fast against the consumer. Another half pint of water was withdrawn, and the meter registered correctly, neither for, nor against, the consumer. It was now that the diminution of the water would begin to give a registry against the company; and another half pint of water was withdrawn from the meter. What was the result? Why, the hollow ball of metal which kept open the valve by which the gas flowed into the meter, was no longer buoyed up by the water; it fell, and, closing the valve, the lights, of course, went out. In fact, the meter would not register against the company at all; the gas was shut off at the very moment the register was about to go in favour of the consumer, and this, too, in a meter that would, as was proved, work 22½ per cent. against the consumer. Five ounces of water were then added, but the valve remained closed; but another 2½ ounces being put in, the meter was again in working order. Now, he thought it would be admitted that water, accumulated in, or poured into, the gas-meter, did produce a very material alteration in the registry. It was a remarkable fact, that while meter makers and others denied that water accumulated in the meter, no fewer than four improved meters, made for the purpose of getting rid of the water, had been sent to him for experiment. The question was also asked on the previous Tuesday—"Does not water accumulate in the dry meter?" The inventor of the improved dry meter, Mr. Defries, replied that water did accumulate, and that he had, at the desire of the chartered gas company, placed a box with a syphon on each side of the meter, to receive the water, which either came with the gas from the factory, or was took into the machine from the fittings attached to it. He (Mr. Jones) thought this conclusive as to the fact of water accumulating in meters. It had been observed by Mr. Sharp, the manager of the Winchester Gas-Works, and the statement proved the truth of his (Mr. Jones's) objection to the variation of the level line, and the evil consequences of frost, condensation, and evaporation in water-meters, that it would be a most important matter both to consumers and gas companies, if a dry meter that would work well, could be got, but he had spent a deal of money, and had failed. To this, the inventors of the dry meter replied that it did not follow that every body must fail, because Mr. Sharp had failed, and that Bolton and Watt's first steam-engine was a very different machine from the improved steam engines of the present day. It was not for him (Mr. Jones) to go into an inquiry, whether the dry meter was better or worse than the wet meter, all he had to do was to lay before them the construction of the dry meter, and leave the public to judge for themselves. They would observe that the dry meter had no level line, as in the case of water meters, and that it was, consequently, not liable to the variations he had been adverting to, as arising from evaporation, condensation, or freezing. When once it was brought to register correctly, it must continue to work so long as the material of which it was composed lasted. They would perceive from the skeleton of the dry meter he held in his hand that it contained three flexible partitions by which the gas was measured. These partitions had, at the previous meetings, given rise to a great deal of excitement. It was stated that the ammonia, naptha, and sulphur of the gas would operate destructively upon them, and several persons desired to see some dry meters that had been for some time in use. The consequence was that several were sent to be tested. One was sent by a gentleman (he believed a solicitor) of the name of Howard, who conceived it to be registering very grossly against him, and some of the gas-meter makers informed him it was what they termed a "fast trotter." He was, indeed, confidently assured by one that it was 22 per cent. fast, and by another, next per cent. fast against the consumer. His answer was, let it undergo the same ordeal that the others had been subjected to, and let the public be informed of the result of the experiment. The meter was put to the test, and it proved to be accurate—neither for nor against the consumer. Another dry meter, which had been up two or three years, was next tested, and found also to be accurate. The gas having entered the inlet, passed through a circular ring into the valve chamber, from whence it descended into the flexible partitions below, when the measurement took place. The gas passed on either side of these partitions, until the levers in the upper part of the meter were brought to their full extent. This produced a change of valves, and the current of gas was reversed, and so by an alternate change of the valves, a reciprocal motion and constant

and equal flow of gas was kept up. The motion, as they would easily perceive, was at once simple and beautiful. The chief argument against the use of the dry meter urged on Tuesday last was, as to the durability of the materials employed in the construction of the flexible partitions, and against the working of the valves. It was stated by the manager of the Winchester Gas-Works, that the ammonia, sulphur, and naphtha from the gas would destroy the part on, and that the valves would not bear for any great length of time the fric a to which they were subjected to. The reply to this was made by the proprietor of the meter, who stated that he had guaranteed the gas companies that the dry meter should last for five years, and that the wet meters were guaranteed for only three years. Mr. (Mr. Jones) asked, at the last public investigation, whether any further objections had been raised against the dry meter, and he was requested to tilt it in the same manner that he had tilted the wet meter. It was tilted to an angle of forty-five degrees, but it continued to register gas as before. With these plain facts, he left the public to judge for themselves the questions of gas meters. One thing, however, he might venture to assert, that the formation of the standards of measurement ought not to be left to the gas companies themselves, and that the consumers of gas ought not to be called upon to use meters tested by such standards. It was time that they called for the appointment of a public officer, whose duty it should be to test the accuracy of gas-meters. Till that was done, the public mind would never be satisfied upon the question. If the licensed victualler used a measure that gave less than the proper quantity, or the butcher a weight short of the just standard, he was fined; and he wished to know why it was that the manufacturers of gas-meters were not placed under the same wholesome regulation? He was satisfied that not only this must be done, but that the standards of the gas companies must be under the supervision of a public officer, before the question now agitating the public mind could be permitted to rest.

At the expiration of the lecture, Mr. Tweed, according to his proposal on Tuesday last, handed in the following paper:—

Mr. Jones and Mr. Tweed each to appoint an umpire, the two to appoint a third, the five to make such experiments as are deemed necessary, for the annexed purposes:—

1. To ascertain the water lines of any given number of meters selected indiscriminately, including the improved, as well as old, water meters; and whether the average is in favour of the consumers or of the gas companies?

2. Whether the principle of the old water-meter is such as to afford an exact measurement of the gas passing through them; and, if not, what is the average amount of the deviation?

3. The same as to Milne and Botten's, and any other improved meters?

4. The same as to the dry meter, particularly Defries' and Clegg's?

Mr. Jones requested time to consider if he should accept the challenge, saying that he should prefer Prof. Brande as his referee, if he could persuade that gentleman to act.—The parties then separated.

WESTMINSTER LITERARY AND SCIENTIFIC INSTITUTION.

Mr. Wright, on Tuesday, the 7th instant, delivered a lecture on Gas Meters at the above Institution. The lecturer commenced by stating, that the subject which he had that evening to bring before his auditory, was one of the greatest importance to the public, not only because it embraces some of the most beautiful laws of nature, and was, therefore, in a scientific point of view, well worthy of attention, but because, in the present advanced state of gas illumination, it entered largely into the accounts as an article of domestic expenditure. The great benefit conferred upon the community by the introduction of coal gas, as a substitute for the more primitive mode of lighting, could not be over estimated; but the advantages arising from that source could never be thoroughly disseminated until the measure by which it is supplied is understood and known to be alike impartial to the consumer and gas manufacturer. When the uncertain contracts, which were still too generally entered into, were entirely done away with, and the gas meter universally adopted, then and not till then, would the gas companies be enabled to supply the consumers at a reduced price, and at the same time increase the dividends on the shares, which were now, on the average, much below what the speculation demanded. He could not but view with regret the late attempt which had been made to unhinge the public mind respecting the accuracy of these measures, as, from whatever the motive might have been in which it has originated, it must defer the accomplishment of that most desirable object. Had the public been well informed upon this subject, these attacks would have failed in producing the effect they have done, and the absurdities contained in the Pamphlet which led the van in this crusade against water meters, would have proved a sufficient antidote, and only created a little merriment at the expense of the author. But, unfortunately, these absurdities were not detected by the public, and, by the exaggeration of defects which the water-meter, in common with all human contrivances, was liable to, and by converting general and unusual occurrences, they have contrived to bring a charge of fraud and robbery against gentlemen of the highest respectability. He would trust to a fair explanation of these machines, as the best refutation which could be given to these calumnies. When he reflected upon the ingenuity of the gas meter, he could not but feel surprised that the public had not long ago felt more interested in this subject, since it was found that persons were generally better informed upon matters less concerning their immediate interests. The steam-engine, for example, was generally understood by most men, and almost every turn in mechanics, fashioned to himself some rude model of this stupend ous machine; yet the gas meter, which entered into the very homes of the public, noting down ever y atom of that most subtle fluid which passed through its chambers, was very imperfectly understood. He hoped that it would not prove uninteresting to his hearers to hear by what mighty power these wonders was accomplished, and how the ingenuity of man had been able even to grasp the winds of Heaven, and determine their quantity. That science might be said to have sprung into existence within the last thirty years; as, previous to that time, no self-acting machine for measuring fluids was in use, and the process by manual operations was exclusively confined to the research of the philosopher. He would not tire the patience of his hearers by entering minutely into the various improvements which had been made since the first introduction of the gas meter by Mr. Samuel Clegg, but he would show the different modes by which gas might be measured, and afterwards such of the places as demanded particular attention from their usefulness or ingenuity, but previous to so doing, he would call their attention for a few moments to the nature of coal gas, and the conditions which affected its bulk, and, consequently, interfered with its (the centrally speaking) correct measurement. Much had been said upon the dangers attending the use of gas, but he would inform his auditors that gas of itself was not explosive, but only so, when mixed with a certain portion of atmospheric air, which was easily proved by experiment, which experiment would also prove that pressure was not necessary for preventing those dangerous effects, as had been stated. The lecturer here filled a small bladder with gas, and burned it out without any injury to the bladder, and without using any pressure. Several assertions had been made, that wet gas-meters measured differently at different pressures. This was not the case. That the wet meter, as well as any other meter which had yet been brought before the public, would measure a cubic foot, he would admit; the capacities of the chambers were not altered by that pressure. The law of compression (said the lecturer) was this:—Suppose the range of the barometer to be two inches, the simple hole pressure would make a difference (for instance, between twenty-eight and thirty inches) of about 7 per cent. In the density of the gas, while, allowing the range of pressure of the gas companies, produced by mechanical means, to be three inches of water, it would only be one-eighth of that produced by the atmosphere, or under 1 per cent. An experiment was here entered into, to show the effect of pressure produced by mechanical means, by pouring a certain portion of mercury upon air in a graduated gauge. The lecturer stated he had marked ten inches in a graduated tube, which was divided into 100 parts—the pressure of the barometer was thirty inches; it he added to this one-tenth part of the barometrical column, or five inches, of the barometer, the difference would be apparent. Here was a pressure of five inches of mercury, and the air in the other end of the gauge was 5 cubic inch less in volume than it was previous to the addition of the mercury, to that, if it was 5 cubic inches before, it now stood at 95 cubics. Now, the greatest pressure of the gas-works being only three inches of water, which was only one-fourth of an inch of mercury, the difference produced by mechanical means was consequently under 1 per cent., which was a mere trifle on either side. The lecturer then entered into the question of the expansion of the gas by heat, and the construction of the same by cold, contending that, as the gas was always measured out from the gas-works at 60°, and in passing through the mains became reduced to 52°, that the 8° difference was equal to 3 per cent. in favour of the consumer. This was exemplified by partially filling a bladder with gas, which, being heated, expanded to the full size of the bladder. The lecturer then stated that the objections were, arising from what cause they might, almost invariably in favour of the consumer, and against the gas companies, and not, as had been publicly stated, against the consumer, and in favour of the gas companies. He then alluded to the objection a he had made to the experiment of Mr. Jones's standard, stating that Mr. Jones had promised to publish his (Mr. Wright's) objections and Mr. Atkin's reply, and circulate the same, but had, however, failed to do so. The said author (or by said intimation would be, the various methods in use for measuring gas; perhaps, the oldest, and by far the most convenient, in practice, as well as the most accurate, was by displacing liquids (such as water is necessary) from chambers, or cylinders, of known dimensions, by means of the gas to be measured. The graduated tube, and the horizontal length of the laboratory, and the gas holder and gas meter so generally used, were but modifications of this principle. Fluids may also be measured by means of an air-tight piston, working in a cylinder. Mr. Barker took out a patent in April, 1815, for a self-acting machine upon this principle; the pistons being propelled backwards and forwards by the pressure of the fluid to be measured, when the piston had arrived at one end of the cylinder, it acted upon valves which shut off the supply from the other of the pistons it had previously been at, and opened it to the outlet, while, at the same time, it shut off the outlet from the opposite side, and opened it to the inlet—thus giving a constant supply, by filling one side of the cylinder while the other was being emptied. That this system worked accurately, either gases or liquids, there is no doubt, but the great friction necessary to work it must ever debar it from being generally used as a gas-meter. Another method has been brought before the public lately with much more success, in which liquids have not been used, but by means of flexible materials, such as prepared silk, oil-skin, &c., and by whatever to have explained the modification of this—Mr. Defries' dry meter, which is the best of its kind, but this lecturer felt a bone got up to such merits, he had not been able to procure one; but if Mr. Defries would lend one, he would give an impartial description on the next Tuesday. Mr. S. Clegg had also invented a new method of measuring gases, or rather informing how much has passed in a certain time; this is done by means of dividing the current of gas into two channels, one of which is heated by means of a jet of gas kept burning to an adjusting character, while the other remains at its ordinary temperature. These currents pass, the hot received in the upper, and the cold received in the under half of a prism of glass (being more a prism); this causes an oscillation, and the number of oscillations are marked upon the index, and measure the quantity of g s consumed. This has never come into use in England, from its delicate and complex nature, but, as Mr. Clegg is about to bring out an improvement upon this, it would be better to leave any remarks until that appears. He mentioned it here, because, although it will be of but little use to the practical man, the extraordinary ingenuity displayed in its details are well worthy of his attention. The only other method he would enumerate would be that of inferring the quantity passed through orifices of certain dimensions. Sir W. Congreve had taken advantage of this in his patent; he proposed to have an outlet of certain dimensions, regarding to the number of lights to be supplied, with a clock movement attached to it, and so arranged that it should move when the cock was open, and stop when it was shut, and that an index should be attached to the clock, which should move at the rate of so many feet per hour, that being the greatest quantity which the cock could pass. This plan is open to many objections, since it could only register correctly when all the lights were burning, and when the pressure was the same as when the cock (at the inlet) was regulated.

The lecturer then alluded to the fact of condensation taking place, and more particularly evaporation; he stated, that he had lately examined two stationary meters, one for 200 lights, in which, in the space of nine months, there was one inch of water deficient, or below the water line; but, in a large meter like this, it would not make more difference than 1 or 2 per cent.; and another, with one-eighth of an inch below the level, which supplied the Thames Tunnel, both in very damp situations, where it would be supposed that the water would be more likely to accumulate. The principle of the action of the water meter was then explained, showing the various improvements which have been made lately to get over the acknowledged variation of the water line, which he stated to have been accomplished by Crossley's, Botten's, and Edge's patents—any of which he should be happy to explain at the next lecture, if sent to him for that purpose. He stated that an outcry had been got up against the water meter, because of the accumulation of water, while he, and many others, could state from experience, that it was not one case in a hundred where that did take place, and, even in that one case, the quantity was always very small; yet, to remedy that insular case, those improvements had been made. He considered that, as meters were now made, the greatest variation that could occur would be about 1½ per cent. either way—which measurement would not be disputed by any reasonable person. To show that the meter makers had not been asleep as to improvements in that machine, as Mr. Jones had led the public to believe, the lecturer explained the different improvements that had taken place within a few years, not only in the meter, but in all the apparatus connected therewith.—[On Tuesday next Mr. Wright will give a description of the dry meter, and enter into the comparative merits of the wet and dry system.]

LATEST IMPROVEMENTS IN CHRONOMETERS.

The vast importance of correct machines for the division of time, even in the every-day occurrences of life, are evident to all; but in philosophical experiments, and for scientific purposes, it is impossible to arrive at accurate conclusions, without time-keepers which may be depended on; and the instrument assumes a still higher degree of importance when used for the purposes of astronomy and navigation. In the earliest history of the watch and clock manufacture, it was known that the variation of the temperature of the atmosphere affected the tension of the balance-spring, and also the length of the pendulum, and that the instrument was made to go faster or slower accordingly. For many years past, ingenious devices of various descriptions have been applied for the purpose of counteracting this serious evil; and many chronometers, by eminent makers, have been tried at the Royal Observatory at Greenwich, and found to vary, in the course of twelve months, only a few seconds. Among the manufacturers who have spared neither time or expense in the laudable endeavour to perfect this instrument, is Mr. Dent, of the Strand, and Cockspur-street, who has just published a small pamphlet, descriptive of an improved compensation balance, for which he has taken out a patent. He observes, "that the improvement in chronometers, during the past fifty years, affords but little room for congratulation, and must convince every one that the road to perfection in the arts is a wearisome one, and more frequently leading to profitless trouble than the public advantage and the interest of the inventor." By continual investigation, however, on this subject, a curious fact has been discovered connected with the above—viz.: "That if chronometers, as generally constructed, be regulated to mean time at mean temperature, the instrument will lose at the extremes of heat and cold; and if adjusted to keep mean time at the extremes, they will have a tendency to gain at the intermediate temperatures. This fact, though probably before known to others, was first pointed out by Mr. Dent, in No. 14, of the *Nautical Magazine*, in 1833;" and, after years of application, he has succeeded in producing a compensation balance, which varies the inertia so as to effect a nearer approximation to correct the varying tension of the balance spring, when acted on by changes of temperature. We have not sufficient space to enter upon the tabular matter and mathematical formula, on the vibration of the balance and tension of the spring, which is so ably given in the pamphlet, but conclude with a description of the ordinary compensation balance and its defects, as also the one patented by Mr. Dent, and which forms the subject of this notice. The ordinary compensation balance consists merely of a common balance bar, at each end of which is a segment of compensating laminæ of brass and steel, the brass being outside the segment, and the steel inside. On each of these laminæ is a compensating weight. By this arrangement, on an increase of temperature, the moveable extremities of the segments approach the centre of motion, and the reverse takes place on a decrease; and, on examination, it will be evident that this action is exactly opposed to the true one—viz. that the inertia may correspond with the tension; to affect which, the weights, on an increase of temperature, should approach the centre with an accelerated motion, and on a decrease, with a retarded one. Mr. Dent's improved balance is represented in the following engravings:—

Fig. 2.

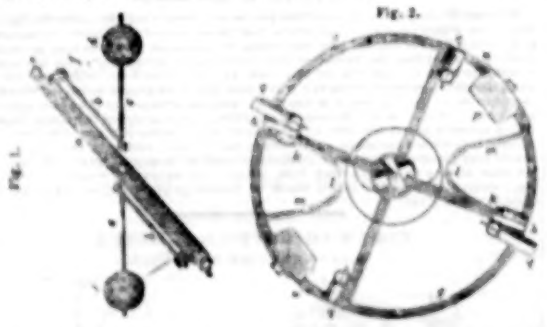


Fig. 1.

FIG. 1.—*a* is a simple balance-bar, made of brass or other non magnetic metal; *b*, two primary compensation pieces of brass and steel, or other such metals, firmly fixed on the balance bar, *a*, and run parallel with it towards the centre; *c*, two continuous secondary compensation pieces attached to the free ends of the primary pieces, *b*, and proceeding in a direction from the centre—the brass of these pieces is, in both cases, at the inside of the angle, and the steel outside; *d*, the compensation weights; *e*, the timing weights.

FIG. 2 shows the plan of a balance, in which the primary and continuous secondary compensation is obtained by means of one curved piece on each side of the balance; *g*, the balance; *h*, two studs raised above the face of the balance, to form the supports of the compensation; *k l m*, two laminæ, each curved in such manner as to combine the joint effect produced by the primary and secondary compensation pieces, shown at *b* and *c* of fig. 1, the part from *k* to *l* (fig. 2) corresponding to the primary compensation piece, and that from *l* to *m* corresponding to the secondary compensation piece of fig. 1; *n*, two prolongations from the ends of the compensation pieces, of steel only; *p*, two compensation weights, screwed to the prolongations, *n*; *q*, four timing weights.

Fig. 1 shows the pieces straight, in order to facilitate the clear understanding of the principles of the invention; and Fig. 2 shows its application in practice. By this means, on an increase of temperature, the weight *p* is moved further from the junction of the primary compensation piece *b*, with the bar; and, as the length of the dotted line *f* (Fig. 1), drawn from the centre of gravity of the weight to the junction with the bar, is augmented by increase of temperature, the compensation weight *p* (Fig. 2), makes a quicker and nearer approach to the centre of motion than in the old balance, and, on a decrease of temperature, the contrary takes place. This is a general explanation of the invention, which embraces every modification of the principle, several different forms of which are shown in the pamphlet; and its importance may be judged from the fact, that Mr. Dent, by it, has produced a chronometer nearer the truth than any before manufactured, its variation in twelve months having only been 0·34, or but little more than half a second; for which he obtained the government prize in 1840.

BRISTOL AND EXETER RAILWAY.—As a proof of the confidence of capitalists in this undertaking, we can state that the whole sum proposed to be borrowed, having for some time past been subscribed, the loan notes (paying interest at 5 per cent. per annum) are now eagerly sought at a premium. The shares, too, have of late greatly improved in value, it being now ascertained, beyond all doubt, that the income, under the lease, will enable the directors regularly to declare dividends, equal to at least 4 per cent. per annum on the paid-up capital. The shares (70*l.* each) are now quoted at 71½*l.* to 73*l.*; at the latter price they yield a return of 5½ per cent., but they must advance.—*Bristol Mercury.*

COLONIAL LAND COMPANIES.—No. V.

THE CANADA COMPANY.

The object of this company is to promote emigration to the British possessions in Upper Canada, for which purpose they have large tracts of country in various parts of that territory. The total number of acres owned by the company is above 1,500,000; but the principal estate, and to which the attention of capitalists and emigrants is now directed, is situated on Lake Huron.

The Huron district, consisting of above 1,000,000 acres, is of a triangular shape, its base, which is seventy miles in length, resting on Lake Huron. To the north of it is a tract of Government land, now being surveyed, which will be added to the district, the total extent of which will then be about 1,700,000 acres. It extends from the western extremity of the Gore district to Goderich, on Lake Huron, and from Goderich to London, in the London district. The company has formed two main roads in these directions, from which the others diverge, some of which are partially macadamised. The principal town of the settlement is Goderich, which is situated on the banks of the river Maitland. The situation of this town is high, dry, and extremely salubrious; one portion is placed nearly on the level with the river Maitland, the other on the high and lofty table land forming its bank, commanding a most extensive view of the lake and river. The streets are well laid out, and all centre in a large circular market-place, near which the new court-house has been erected, and a large brewery, built by a settler from Wiltshire. There are several excellent taverns, and every requisite for advancement in population and wealth. A large and substantial bridge has been built by the company, to connect the two sides of the river; and the harbour, by the construction of a long and solid pier, has been rendered safe, deep, commodious, and easily accessible. This pier, which runs out into the lake, permanently secures a draft of ten feet of water over the bar which is always formed at the mouth of a river where the strength of the stream is neutralised by the force of the lake or sea into which it flows. Within the harbour is a capacious basin, having nearly eighteen feet of water, completely protected from the wind, in whatever quarter it may be, and always accessible. The rivers and lakes abound in fish, among which may be enumerated the sturgeon, river-trout, pike, pickerel, maskononge, mullet, carp, sucker, herring, white-fish, bass, sun fish, cat fish, and an undescribed species of the salmon tribe, called "Makinaw trout." The fisheries around Saugia Island, in Lake Huron, are inexhaustible; and the results of the individual exertion of one settler, in 1840, was nearly 600 barrels of salmon, herrings, and white-fish. The fisheries, together with the superior harbourage, and the natural facilities for agricultural industry in the territory around, makes Goderich one of the first ports on the borders of Lake Huron. Game is abundant, except in the townships of Goderich and Colborne, where, from the advances of agriculture, it has become scarce.

The land in the Huron district is, generally, of a loamy description; sandy loam, with lime-stone gravel, on the verge of the lake, and clayey loam towards the interior, covered everywhere, to a considerable depth, with rich vegetable mould. The whole country may be said to be bedded, at various depths, on a recent lime-stone, though this is sometimes varied with sand-stone, which, however, is not pure, but seems to have been a stratum of sand bound together with lime. At Kettle-Point, there is a formation of clay-slate, having embedded in it globular pyrites; on the lake-shore are found detached masses of serpentine; and in every part of the tract masses of red, silver, and grey granite, which are sometimes water-worn, but are often as sharp and angular as if recently taken from the quarry. Very little is known about the mineral riches of this part of Canada, the all-important pursuits of agriculture having, as yet, left but little time for such researches; magnetic iron-sand, however, is found in abundance on the shores of the lake, and some slightly salt and chalybeate springs have been met with in different parts of the country. At Kettle Point a good deal of sulphur is to be procured, and lead ore exists in the rear of it; but the Indians, to whom alone it is known, keep its locality a secret. The climate is exceedingly healthy; intermittent and remittent fevers, which are generally the scourges of new settlements, are unknown (except when imported), which arises from the whole country being a table-land, varying from 120 to 300 feet above the level of Lake Huron, and from 480 to 660 above that of Lake Ontario. The climate is also milder than that of other parts of America lying in the same latitude, owing to the prevailing winds blowing across Lake Huron, which cool the air in summer and temper the cold in winter, as, from the great depth of the lake, it never freezes across. J. Buchanan, his late Majesty's Consul at New York, says, "The fine climate of Upper Canada is not generally understood in England; nor is it known that tobacco, peaches, and the vine comes to great perfection throughout an extensive region. Wheat, the vine, and tobacco, found in any country, are indications of the most favourable kind; but to these I add that most valuable of all grain, the Indian corn." The principal timber is maple, elm, beech, and bass; and, in lesser quantities, cherry, hickory, ash, oak, hemlock, and pine; the latter, however, is scarce. Black walnut grows in the southern part of the tract, in the neighbourhood of the river Sable. From the maple the settler procures his supply of sugar, by a very simple process; and most of these trees are fit for the manufacture of potash, from the burning necessary to clear the ground, the produce being sometimes sufficient to pay for the land, and the labour of manufacture.

This country is a most gratifying testimony as to the effect of industry, possessing, as it does, a prosperous, wealthy, and contented body of settlers, who commenced the subjugation of the forest with scarcely any other capital than health and perseverance; and, to show how it has advanced since the commencement of the proceedings of the Canada Company, in 1829—then a wild forest, with the Indian for its inhabitant—it will only be necessary to give a statement of its present population and improvements. According to the last statement, made up to the end of 1840, the population then consisted of nearly 5000 souls, who possessed, collectively, 949 yoke of oxen, 2606 cows, 690 horses, 4772 young cattle, and 8852 pigs; the whole worth, at a low estimate, 56,000*l.* There were then 22,909 acres cleared and under cultivation, and 1769 chopped, 1312 dwelling-houses, and 1144 frame buildings; which improvements were valued at 186,206*l.* The amount of capital introduced by these settlers, at the various times of their arrival, was, up to 1840, 60,110*l.*, showing a balance in favour of mere industry of 182,176*l.*, in twelve years from the first settlement in the country. Of these emigrants, 514 families, on going on the land, were destitute of any means, yet in 1840 the collective value of their stock and improvements was 90,486*l.*; sixty-one families had, at first, means under 10*l.* each, and the value of their stock and improvements was estimated at 10,424*l.*; and 254 families had means under 50*l.* on their arrival, but whose stock and improvements had increased to the value of 40,526*l.*; the value of stock and improvements possessed and made by individuals whose means had exceeded 50*l.* was 100,856*l.* In 1840, there were eight grist-mills, eighteen saw-mills, two tanneries, seven distilleries, and a brewery. A number of villages are forming in various parts of the tract, and a progressive improvement has, since the date of these returns, been made; which is shown more particularly by the remittances that have been made to this country by emigrants in Upper Canada (now called Canada West), to enable their friends to join them; for while, in 1840, 365 settlers sent home to their friends 3027*l.*—in the past three months, of 1842, 250 persons sent home 2284*l.*; and, through four banks alone, nearly 21,000*l.* has been sent to England, by 2455 settlers, in a period of eight years, being an average of 8*l.* 18*s.* from each person, and showing that the numerous body of settlers have not only been enabled to support themselves and families in Canada, but that they have been so satisfied of the advantage it will be to their friends to join them, that they have exceeded in sending over this considerable sum to assist them in the furtherance of that object. There are many instances of an increase of capital ten-fold, and other cases still more startling, where the increase in value has arisen from local circumstances and peculiarities; but the general tenour of accounts from settlers, and such statements as have been made for the use of Government, go to prove that with little capital—so small as to be useless in England—and with common industry, and only the necessaries of life, but long steps towards a permanent provision, may be made there; and, indeed, industry of itself is sufficient, as that alone, properly applied, will raise the capital, and, perhaps, render its possessor nearer the grand object—independence—than those who, from having capital to commence with, had, apparently, the start.

This statement only comes up to the end of the year 1840. The latest accounts received show that a very rapid increase has recently occurred in the population, which now amounts to nearly 9000, owing to the facilities afforded by the Canada Company to individuals settling upon their land, and the excellence of the soil and climate of the whole district.

MARINE PLUMBAGO.—An analysis of a piece of iron, converted, by action of sea water, into a substance resembling plumbago, is given as follows:—This substance was of a dark brown colour, and easily cut with a knife; and Mr. Mushet undertook to analyse it. The substance being exposed to a red heat, in a crucible, lost about 20 per cent. in weight, and on being exposed to a white heat for four hours, lost about 68 per cent., and came out a very brilliant carburet. The following is the analysis of the marine plumbago as compared with the common black lead:—

MARINE PLUMBAGO.		BLACK LEAD.	
Carbonic acid and moisture	20	Carbonic acid and water	120
Protoxyde of iron	30·7	Iron	120
Earthy matter	7·3	Earthy matter	40
Carbon	42	Carbon	720

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